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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/053,446	01/17/2002	Janis Virbulis	WSAG 0128 PUS	3544

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EXAMINER	
SONG, MATTHEW J	

ART UNIT	PAPER NUMBER
1722	

DATE MAILED: 08/08/2006

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	10/053,446	VIRBULIS ET AL.	
	Examiner	Art Unit	
	Matthew J. Song	1722	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *02 June 2006*.

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1,2,14 and 17* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-2, 14 and 17* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☐ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: _____.

DETAILED ACTION

Claim Rejections - 35 USC § 103

1. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

2. Claims 1 and 2 are rejected under 35 U.S.C. 103(a) as being unpatentable over Iida et al (US 6,077,343) in view of Haida (DE 3701811 A1), an English Translation (ET) has been provided.

In a method of forming a silicon single crystal, note entire reference, Iida et al teaches an apparatus for pulling a silicon single crystal according to the Czochralski method comprising a crucible **32**, an annular solid-liquid interface insulator **8**, an upper surrounding insulator **9**, and a radiant heat reflecting plate attached to the lower portion (col 10, ln 30-65; col 11, ln 20-45; and Fig 3), this insulator and reflecting plate meets applicant's heat shield above the crucible limitation. Iida et al also teaches applying a magnetic filed to the silicon melt in a vertical

direction or in a like direction to suppress a convection of the melt to thereby stably grow a single crystal (col 10, ln 60 to col 11, ln 5). Iida et al also teaches growing crystals having a diameter of 8 to 16 inches (~200-400 mm) would possible (col 14, ln 35-40) and using a crucible with a diameter of 18 inches (~457.2 mm) (col 13, ln 1-10).

Iida et al does not teach using a traveling magnetic field.

In a method of growing single crystal silicon in a Czochralski process, note entire translation, Haida et al teaches using a downward moving traveling magnetic field is applied to prevent the rising thermal convection flow in the melt from reaching the walls of the pot (pg 8-9). Haida et al also teaches an intensity of 20-200 Gauss (2-20 mT), this clearly suggests applicant's intensity which is sufficient to attenuate low-frequency temperature fluctuations in the melt because 20-200 Gauss (2-20 mT) is within the range of 2-15 mT taught by applicant teach using 2-15, note page 10 of the instant specification.

It would have been obvious to a person of ordinary skill in the art at the time of the invention to modify Iida et al by using an downwardly traveling magnetic field to prevent the rising thermal convection flow in the melt from reaching the walls of the pot, as taught by Haida.

Referring to claim 1, the combination of Iida et al and Haida et al ('811) teaches a magnetic field around the melt moving down the pot (ET pg 5) to prevent the rising thermal convection flow from decreasing the downward flow (ET pg 8). The combination of Iida et al and Haida et al also teaches a traveling wave is placed in the pot to produce a downward driving power (ET pg 9, ln 1-2), this clearly suggests applicant's applying a magnetic filed to establish a convection which is initially directed to a bottom of the crucible. Furthermore, the combination of Iida et al and Haida et al teaches applying a downward traveling magnetic wave in a range of

20-200 Gauss (2-20 mT) and applicant teaches a magnetic field intensity in the range of 2-15 mT, note page 10 of the instant specification; therefore the traveling magnetic field taught by Haida is expected to produce an initial downward convection because the intensity overlaps the range taught by applicant's to cause a downward convection. A similar magnetic field is expected to produce a similar effect, namely a convection which is initially directed downward.

Referring to claim 2, Iida et al teaches 13-16 ppma, which is greater than $5x10^{17}$ atoms/cm^3, note Wilson et al (US 6,284,384) below.

3. Claim 17 is rejected under 35 U.S.C. 103(a) as being unpatentable over Iida et al (US 6,077,343) in view of Haida (DE 3701733 A1), an English Translation (ET2) has been provided.

In a method of forming a silicon single crystal, note entire reference, Iida et al teaches an apparatus for pulling a silicon single crystal according to the Czochralski method comprising a crucible **32**, an annular solid-liquid interface insulator **8**, an upper surrounding insulator **9**, and a radiant heat reflecting plate attached to the lower portion (col 10, ln 30-65; col 11, ln 20-45; and Fig 3), this insulator and reflecting plate meets applicant's heat shield above the crucible limitation. Iida et al also teaches applying a magnetic filed to the silicon melt in a vertical direction or in a like direction to suppress a convection of the melt to thereby stably grow a single crystal (col 10, ln 60 to col 11, ln 5). Iida et al also teaches growing crystals having a diameter of 8 to 16 inches (~200-400 mm) would possible (col 14, ln 35-40) and using a crucible with a diameter of 18 inches (~457.2 mm) (col 13, ln 1-10).

Iida et al teaches using a vertically oriented magnetic field, however Iida et al does not teach using a traveling magnetic field.

In a method of growing single crystal silicon in a Czochralski process, note entire translation, Haida et al teaches a thermal convection flow occurs is a growing monocrystal is not rotated, and the application of a traveling magnetic flied serves or a further suppression of the undesirable thermal convection flow, without reducing the forced convection flow (pg 10-11 of ET2). Haida et al teaches an upward traveling magnetic filed of 100 Gauss is applied (pg13 of ET2), this clearly suggests applicant's intensity which is sufficient to attenuate low-frequency temperature fluctuations in the melt because 100 Gauss (10 mT) is within the range of 2-15 mT taught by applicant teach using 2-15, note page 10 of the instant specification.

It would have been obvious to a person of ordinary skill in the art at the time of the invention to modify Iida et al by using an upwardly traveling magnetic field to suppress undesirable thermal convection, as taught by Haida.

4. Claim 14 is rejected under 35 U.S.C. 103(a) as being unpatentable over Iida et al (US 6,077,343) in view of Haida (DE 3701811 A1), an English Translation (ET) has been provided, as applied to claims 1-2 above, and further in view of Lari et al.(US 4,905,756) or Morishita et al (JP 61-029128), an English Abstract has been provided.

The combination of Iida et al and Haida ('811) teaches all of the limitations of claim 14, except the traveling magnetic is due to three coils which are connected to a 3-phase power supply and the traveling magnetic field exerts a substantially vertically oriented force on the melt is generated by suitable selection of an order of connections; and the connections of the coils have a phase angle in an order of 0°-60°-120° or 0°-120°-240°. The combination of Iida et al and

Haida ('811) teaches providing a traveling magnetic field but not the claimed means of producing the magnetic field.

In an apparatus for producing magnetic fields, note entire reference, Lari et al teaches a magnetic field traveling wave is produced with only two coil layers with current 180° out of phase and in the preferred embodiment, three coil layers 120° out of phase are used, this clearly suggests applicant's connections of the coils have a phase angle in an order of 0°-120°-240°. Lari et al also teaches an AC source supplies three-phase alternating current. Also, additional coil waves could de used to produce a traveling wave, for example four coils 90° out of phase. It would have been obvious to a person of ordinary skill in the art at the time of the invention to modify the combination of Iida et al and Haida ('811) with Lari et al's means of producing a traveling magnetic field because selection of a known material based on its suitability for its intended use is held to be obvious (MPEP 2144.07).

In an apparatus for providing a magnetic field, Morishita et al teaches a magnetic generator made of a coil **30**, which is formed of coils 31a, 31b 31c. And when a 3-phase AC current having 120° different positions are respectively flowed to the coils, a traveling magnetic field which moves in a prescribed direction is generated (Abstract), this clearly suggests applicant's connection of the coils have a phase angle in an order of 0°-120°-240°. It would have been obvious to a person of ordinary skill in the art at the time of the invention to modify the combination of Iida et al and Haida ('811) with Morishita et al's means of producing a traveling magnetic field because selection of a known material based on its suitability for its intended use is held to be obvious (MPEP 2144.07).

Response to Arguments

5. Applicant's arguments, see page 6 of the remarks, filed 6/2/2006, with respect to the 35 U.S.C 103 rejection over Iida in view of Haida ('733) have been fully considered and are persuasive. The rejection of claims 1-2 has been withdrawn. The amendment filed 6/2/2006 to claim 1 overcomes the rejection.

6. Applicant's arguments filed 6/2/2006 have been fully considered but they are not persuasive.

Applicant's argument that Haida ('733) does not teach an upward traveling magnetic field of 100 Gauss (pg 8) is noted but is not found persuasive. Haida ('733) teaches an upward traveling magnetic filed of 100 Gauss was applied to the crucible, note page 13 of the English Translation.

Applicant's argument that Haida ('811) does not teach "to establish a convection which is initially directed to a bottom of the crucible" is noted but is not found persuasive. The combination of Iida et al and Haida et al ('811) teaches a magnetic field around the melt moving down the pot (ET pg 5) to prevent the rising thermal convection flow from decreasing the downward flow (ET pg 8). The combination of Iida et al and Haida et al also teaches a traveling wave is placed in the pot to produce a downward driving power (ET pg 9, ln 1-2), this clearly suggests applicant's applying a magnetic filed to establish a convection which is initially directed to a bottom of the crucible. Furthermore, the combination of Iida et al and Haida et al teaches applying a downward traveling magnetic wave in a range of 20-200 Gauss (2-20 mT) and applicant teaches a magnetic field intensity in the range of 2-15 mT, note page 10 of the instant specification; therefore the traveling magnetic field taught by Haida is expected to

produce an initial downward convection because the intensity overlaps the range taught by applicant's to cause a downward convection. A similar magnetic field is expected to produce a similar effect, namely a convection which is initially directed downward.

Conclusion

7. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure.

Wilson et al (US 6,284,384) teaches a wafer prepared in a Czochralski process with an oxygen concentration $5x10^{17}$ to about $9x10^{17}$ atoms/cm^3 is equivalent to 10-18 ppm (col 8, ln 60-67).

8. Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

9. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Matthew J. Song whose telephone number is 571-272-1468. The examiner can normally be reached on M-F 9:00-5:00.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Yogendra Gupta can be reached on 571-272-1316. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

Matthew J Song
Examiner
Art Unit 1722

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MJS
August 1, 2006